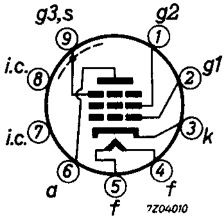
# S.Q. TUBE

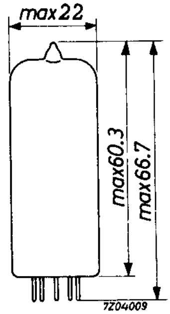
Pentode designed for use in telephone equipment.

| QUICK REFERENCE DATA | | | |
|---|---|---|---|
| Life test | 10 000 hours | | |
| Low interface resistance | | | |
| Base | Noval | | |
| Heating | Indirect<br>A.C. or D.C.<br>Series or parallel supply | | |
| Heater voltage | $V_f$ | 18 | V |
| Heater current | $I_f$ | 100 | mA |
| Anode current | $I_a$ | 10 | mA |
| Mutual conductance | S | 9 | mA/V |

**DIMENSIONS AND CONNECTIONS** Dimensions in mm

Base: Noval



## CHARACTERISTICS

Column I Nominal value or setting of the tube
II Range values for equipment design: Initial spread
III Range values for equipment design: End of life

| | | I | II | III | |
|---|---|---|---|---|---|
| Heater voltage | $V_f$ | 18 | | | V |
| Heater current | $I_f$ | 100 | 95 - 105 | | mA |
| Anode voltage | $V_a$ | 210 | | | V |
| Grid No.3 voltage | $V_{g_3}$ | 0 | | | V |
| Grid No.2 voltage | $V_{g_2}$ | 120 | | | V |
| Cathode resistor | $R_k$ | 165 | | | Ω |
| Anode current | $I_a$ | 10 | 8.7 - 11.3 | min. 7 | mA |
| Grid No.2 current | $I_{g_2}$ | 2.1 | 1.7 - 2.5 | min. 1.25 | mA |
| Mutual conductance | S | 9 | 7.8 - 10.2 | min. 6.4 | mA/V |
| Internal resistance | $R_i$ | 0.5 | min. 0.3 | | MΩ |
| Amplification factor | $\mu_{g_2 g_1}$ | 38 | | | |
| Equivalent noise resistance | | | | | |
| R.F. | $R_{eq}$ | 750 | max. 1000 | | Ω |
| A.F. (0 - 10 kHz) | $R_{eq}$ | | max. 36 | | kΩ |
| Negative grid current | $-I_{g_1}$ | | max. 0.5 | max. 1.0 | μA |
| Cut-off voltage | $-V_g$ | | max. 5.25 | | V |
| Anode voltage | $V_a$ | 210 | | | V |
| Grid No.3 voltage | $V_{g_3}$ | 0 | | | V |
| Grid No.2 voltage | $V_{g_2}$ | 120 | | | V |
| Anode current | $I_a$ | 0.5 | | | mA |
| Hum voltage | $V_{g_1}$ | | max. 0.5 | | $mV_{RMS}$ |
| Grid No.1 resistor $R_{g_1}$ = 0.5 MΩ | | | | | |
| Leakage current between cathode and heater | $I_{kf}$ | | max. 20 | | μA |
| Voltage between cathode and heater $V_{kf}$ = 100 V | | | | | |

## CAPACITANCES

| | | I | II | |
|---|---|---|---|---|
| Anode to grid No.2, grid No.3, cathode and heater | $C_{a/g_2g_3kfs}$ | 3.5 | max. 4.1 | pF |
| Grid No.1 to grid No.2, grid No.3, cathode, heater and screen | $C_{g_1/g_2g_3kfs}$ | 8.0 | max. 8.7 | pF |
| Anode to grid No.1 | $C_{ag_1}$ | | max.0.015 | pF |
| Grid No.1 to heater | $C_{g_1f}$ | | max. 0.15 | pF |
| Cathode to heater | $C_{kf}$ | 4 | | pF |
| Grid No.1 to grid No.2, grid No.3, cathode, heater and screen | $C_{g_1/g_2g_3kfs}$ | 11.3 | | pF |
| Cathode current = 12.1 mA | | | | |
| Radiation capacitance: | | | | |
| Anode to surrounding box, inner diam. 52 mm, height 98 mm | $C_{ra}$ | | max.0.025 | pF |
| Grid No.1 to surrounding box, inner diam. 52 mm, height 98 mm | $C_{rg_1}$ | | max.0.025 | pF |

## LIFE

Production samples are tested to be within the end of life values (column III) during 10 000 hours.

## LIMITING VALUES Design centre rating system

| | | | | |
|---|---|---|---|---|
| Anode voltage | $V_{a_o}$ | max. | 550 | V |
| | $V_a$ | max. | 210 | V |
| Anode dissipation | $W_a$ | max. | 2.1 | W |
| Grid No.2 voltage | $V_{g_{2o}}$ | max. | 550 | V |
| | $V_{g_2}$ | max. | 210 | V |
| Grid No.2 dissipation | $W_{g_2}$ | max. | 0.35 | W |
| Cathode current | $I_k$ | max. | 16 | mA |
| Grid No.1 resistor (automatic bias) | $R_{g_1}$ | max. | 1 | MΩ |
| Voltage between cathode and heater | $V_{kf}$ | max. | 100 | V |
| Bulb temperature | $t_{bulb}$ | max. | 170 | °C |

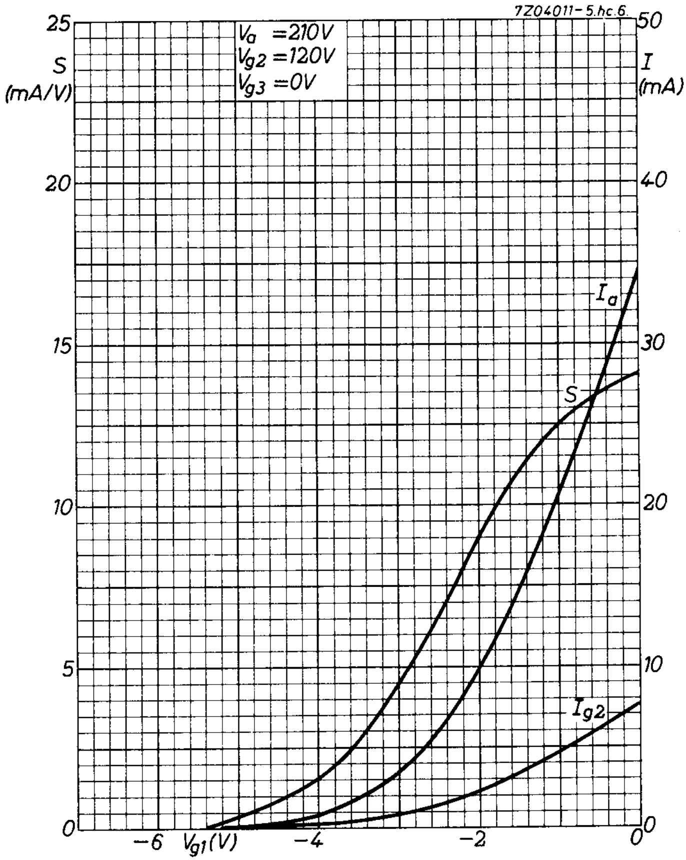
**LIMITING VALUES** (continued)

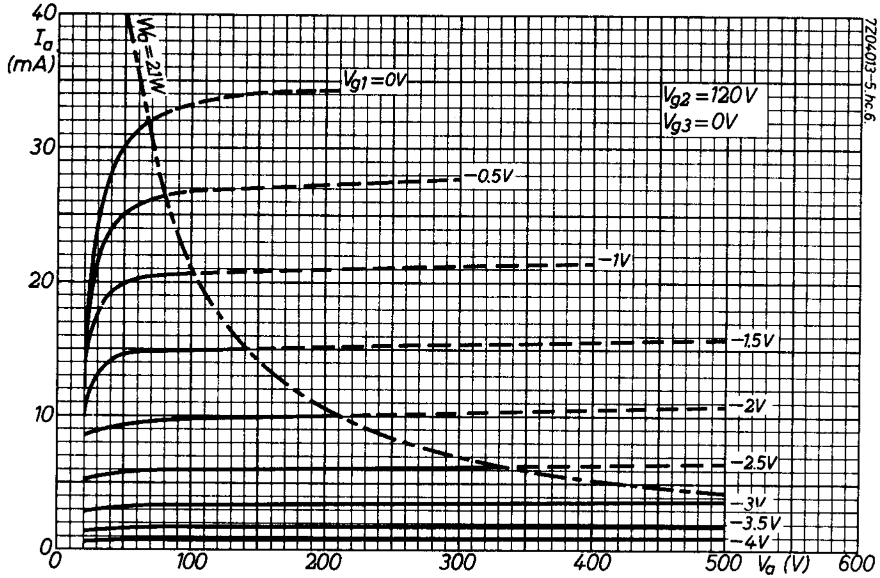
Heater voltage: The average heater voltage should be 18 V.
Variations of the heater voltage exceeding the range of 17.1 to 18.9 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.

**OPERATING CHARACTERISTICS**

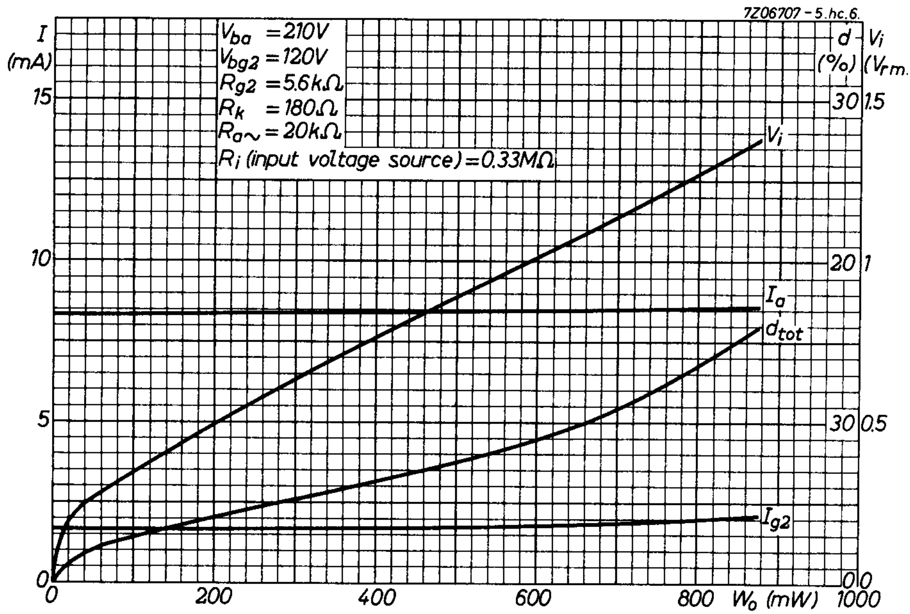
Output tube class A

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Anode voltage | $V_a$ | | 120 | | | 210 | | V |
| Grid No.3 voltage | $V_{g_3}$ | | 0 | | | 0 | | V |
| Grid No.2 supply voltage | $V_{bg_2}$ | | 120 | | | 120 | | V |
| Grid No.2 resistor | $R_{g_2}$ | | 5.6 | | | 5.6 | | kΩ |
| Cathode resistor | $R_k$ | | 180 | | | 180 | | Ω |
| Anode current | $I_a$ | | 8.3 | | | 8.3 | | mA |
| Grid No.2 current | $I_{g_2}$ | | 1.7 | | | 1.7 | | mA |
| Mutual conductance | S | | 8.2 | | | 8.2 | | mA/V |
| Internal resistance | $R_i$ | | 0.42 | | | 0.44 | | MΩ |
| Load resistance | $R_{a\sim}$ | | 10 | | | 20 | | kΩ |
| Output power | $W_o$ | 340 | 400 | 50 | 660 | 870 | 50 | mW |
| Input voltage | $V_i$ | 1.1 | - | 0.35 | 1.1 | - | 0.25 | $V_{RMS}$ |
| Total distortion | $d_{tot}$ | 10 | - | - | 10 | - | - | % |
| Grid No.1 current | $+I_g$ | - | 0.3 | - | - | 0.3 | - | μA |
| Grid No.1 resistor | $R_{g_1}$ | - | 0.33 | - | - | 0.33 | - | MΩ |

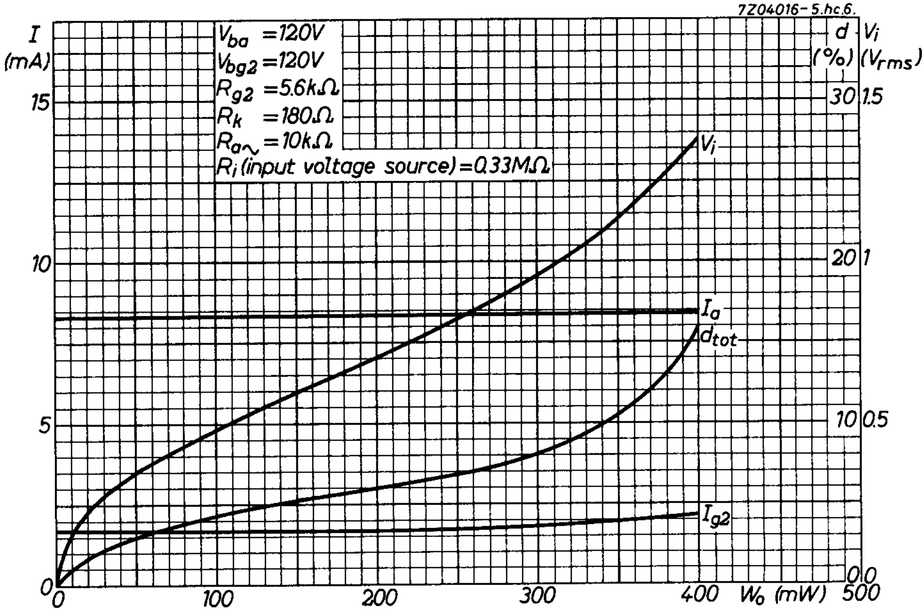

7Z04011-5.hc.6.
$V_a$ =210V
$V_{g2}$ =120V
$V_{g3}$ =0V
S
(mA/V)
I
(mA)
$I_a$
S
$I_{g2}$
25
20
15
10
5
0
50
40
30
20
10
0
−6
$V_{g1}$(V)
−4
−2
0

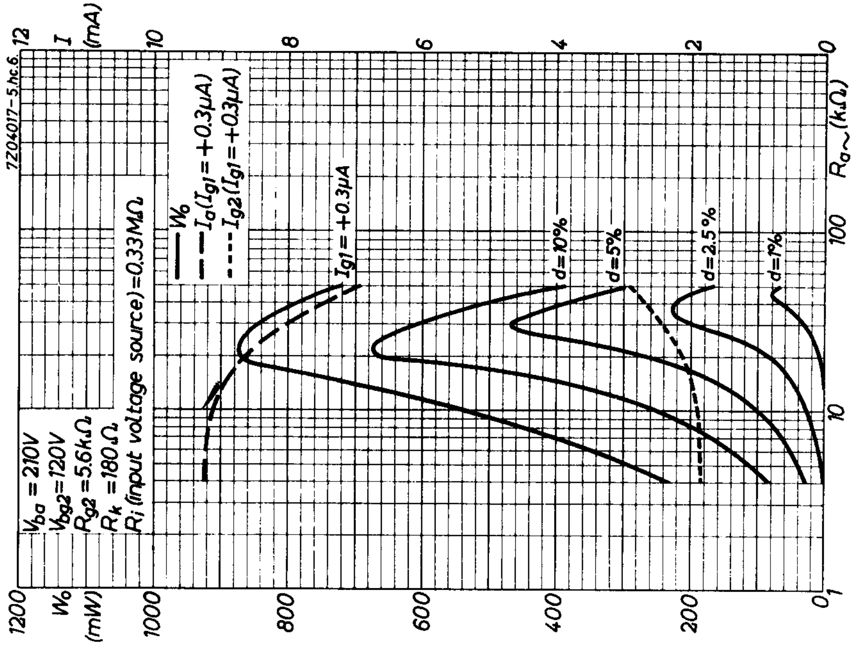


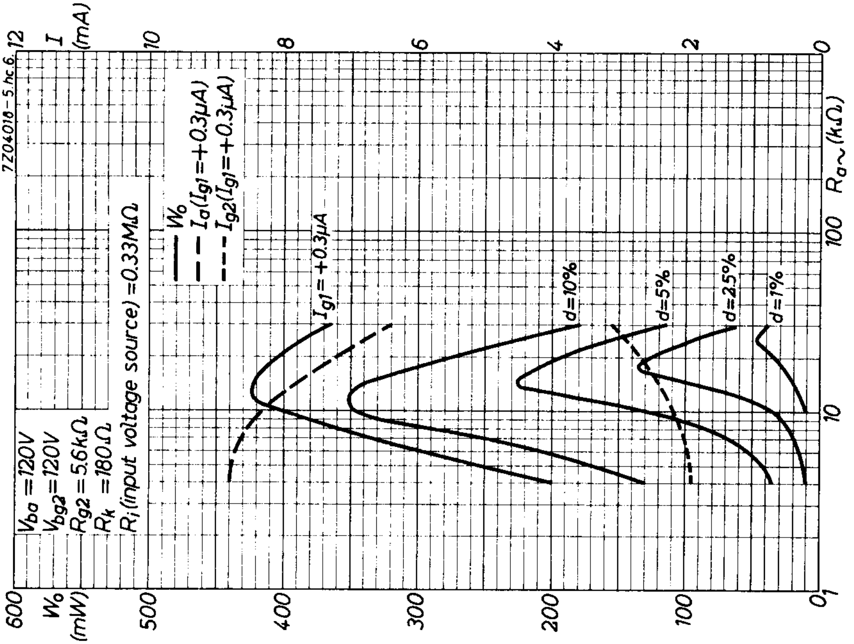
40
$I_a$
(mA)
30
20
10
0
0
100
200
300
400
500
$V_a$ (V)
600
$W_a$ = 2 W
$V_{g1}$ = 0V
−0.5V
−1V
−1.5V
−2V
−2.5V
−3V
−3.5V
−4V
$V_{g2}$ = 120 V
$V_{g3}$ = 0V
7Z04013-5.hc.6.

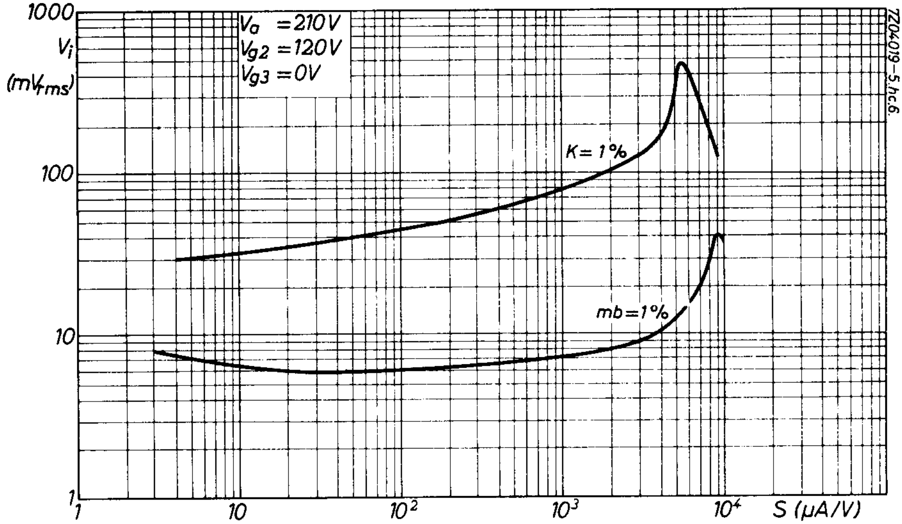



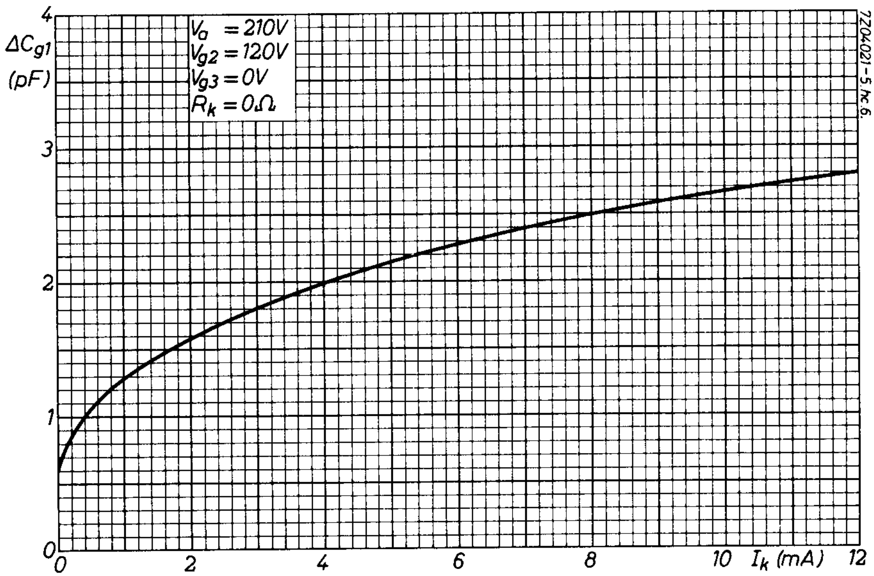
7Z06707-5.hc.6.
I
(mA)
15
10
5
0
0
200
400
600
800
$W_o$ (mW)
1000
$V_{ba}$ = 210V
$V_{bg2}$ = 120V
$R_{g2}$ = 5.6 kΩ
$R_k$ = 180 Ω
$R_{a\sim}$ = 20 kΩ
$R_i$ (input voltage source) = 0.33 MΩ
d
(%)
$V_i$
($V_{rm.}$
30
1.5
20
1
30
0.5
0
0
$V_i$
$I_a$
$d_{tot}$
$I_{g2}$

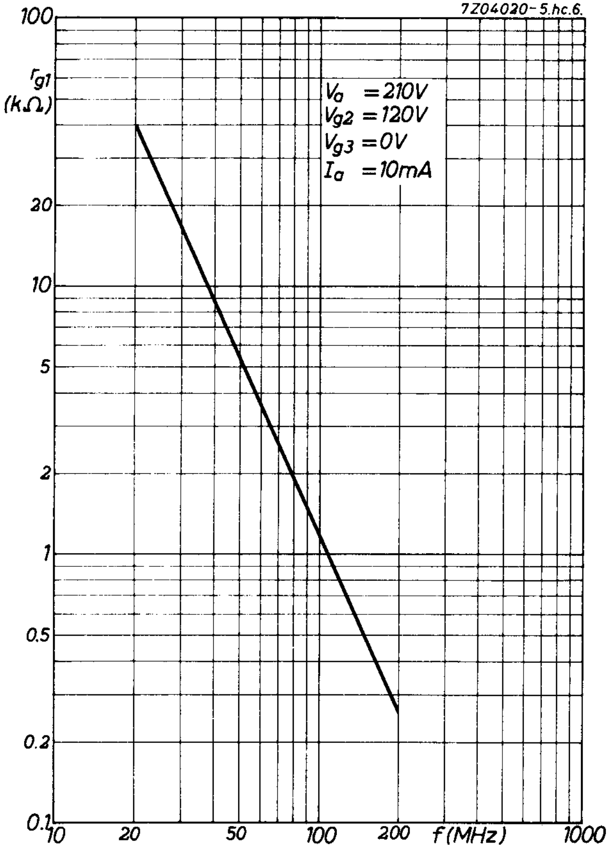

7Z04016-5.hc.6.
I (mA)
d (%)
$V_i$ ($V_{rms}$)
$V_{ba}$ = 120V
$V_{bg2}$ = 120V
$R_{g2}$ = 5.6kΩ
$R_k$ = 180Ω
$R_{a\sim}$ = 10kΩ
$R_i$ (input voltage source) = 0.33MΩ
$V_i$
$I_a$
$d_{tot}$
$I_{g2}$
$W_o$ (mW)
0
5
10
15
100
200
300
400
500
30 1.5
20 1
10 0.5
0 0


7Z04017-5.hc.6.
$V_{ba}$ = 210V
$V_{bg2}$ = 120V
$R_{g2}$ = 5.6kΩ
$R_k$ = 180Ω
$R_i$ (input voltage source) = 0.33MΩ
$W_o$
$I_a$ ($I_{g1}$ = +0.3µA)
$I_{g2}$ ($I_{g1}$ = +0.3µA)
$I_{g1}$ = +0.3µA
d=10%
d=5%
d=2.5%
d=1%
$W_o$ (mW)
I (mA)
$R_{a\sim}$ (kΩ)


7Z04018-5.hc.6.
$V_{ba}$ = 120V
$V_{bg2}$ = 120V
$R_{g2}$ = 5.6kΩ
$R_k$ = 180Ω
$R_i$ (input voltage source) = 0.33MΩ
$W_o$
$I_a$ ($I_{g1}$ = +0.3µA)
$I_{g2}$ ($I_{g1}$ = +0.3µA)
$I_{g1}$ = +0.3µA
d=10%
d=5%
d=2.5%
d=1%
$W_o$ (mW)
I (mA)
$R_{a\sim}$ (kΩ)


1000
$V_i$
(mV$_{rms}$)
100
10
1
1
10
$10^2$
$10^3$
$10^4$
S (µA/V)
$V_a$ = 210 V
$V_{g2}$ = 120 V
$V_{g3}$ = 0 V
K = 1%
mb = 1%
7Z04019-5.hc.6.


4
$\Delta C_{g1}$
(pF)
3
2
1
0
0
2
4
6
8
10
$I_k$ (mA)
12
$V_a$ = 210 V
$V_{g2}$ = 120 V
$V_{g3}$ = 0 V
$R_k$ = 0 Ω
7Z04021-5.hc.6.



7Z04020-5.hc.6.
100
$r_{g1}$
(kΩ)
$V_a$ = 210V
$V_{g2}$ = 120V
$V_{g3}$ = 0V
$I_a$ = 10mA
20
10
5
2
1
0.5
0.2
0.1
10
20
50
100
200
f (MHz)
1000

PHILIPS

Data handbook

Electronic components and materials

**18042**

| page | sheet | date |
|---|---|---|
| 1 | 1 | 1968.12 |
| 2 | 2 | 1968.12 |
| 3 | 3 | 1968.12 |
| 4 | 4 | 1968.12 |
| 5 | 5 | 1968.12 |
| 6 | 6 | 1968.12 |
| 7 | 7 | 1968.12 |
| 8 | 8 | 1968.12 |
| 9 | 9 | 1968.12 |
| 10 | 10 | 1968.12 |
| 11 | FP | 2001.05.13 |